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NOTES ON THE DISCERNMENT OF LIKENESS AND OF UNLIKENESS

THIS research aimed to help the analysis of the mental process by which we become aware of similarity and of dissimilarity. Its method is experimental and it reports the simplified laboratory-judgments as to the likeness and unlikeness experienced in the case of a series of visual forms. The experiments of the work were performed in the psychological laboratories of Columbia and of Harvard universities. The simple-enough apparatus employed consisted of the blots of ink introduced into experimental psychology by the writer and described in the *Psychological Review* of July, 1897. From about five hundred of these largely chance ink-blots made on paper 4 cm. square and mounted on thick pasteboard of like size, one hundred were taken as they chanced to lie in a box, that is, quite at random. The backs of the blot-cards were numbered consecutively from one to one hundred for ready identification. Besides these, four other ink-blots were selected to constitute the norms with which the others were to be compared as to their respective likeness or unlikeness. A wire frame to hold fixed the norm-blot convenient to the subject's vision and a table on which the century of blot-cards could be arranged ten-square in numerical order completed the apparatus employed.

The subjects employed in this research were twenty in number; two were philosophical professors, one an instructor, and two assistants in psychology, while the rest, with one exception, were students in the two laboratories where the experiments were performed, the exception noted being a college graduate. The subjects were all males ranging in age between twenty and forty-three. The chief interest and work of one of the subjects lay in the art of music—a circumstance whose influence will be noted later on. The interests of the others were certainly sufficiently varied to prevent the occurrence of bias in any direction in their subjective reports, no one avowing or evincing any particular prejudice as regards the nature

of the processes under inquiry. All the subjects employed were sufficiently familiar with psychological analysis to afford both their introspection and their subjective reports the requisite accuracy. Here, as nearly always, however, the chief stress was laid on actual reactions rather than on more or less uncertain and ambiguous mental images and ideas, on the principle that bodily reactions express better than other means, even to the subject himself, his real meaning and intention—a fact too often overlooked, perhaps, in the laboratory of psychology.

The method of experimentation in detail was simply as follows: The hundred blot-cards being placed in order ten-square on the table before the seated subject and the norm in its frame conveniently before his eyes and above the blots, he proceeded to select within fifteen minutes the ten blot-cards out of the hundred most similar in form or shape to the norm, and to place them one side arranged carefully and deliberately in the order of their judged similarity to the norm. Meanwhile the subject reported how he apperceived the norm and what he considered its most essential form—characteristics and peculiarities. These subjective notes were recorded and the numbers of the ten blots judged most like the norm, and in their chosen order. The time required for a selection satisfactory to the subject was also recorded, and at the end of the selection the reason why each of the ten had been preferred, concisely as possible. The process in the case of judgments as to unlikeness was precisely the same, with the appropriate change in intention to keep dissimilarity instead of similarity in mind. The subject was not allowed to turn any blot-card about or to observe the characters from more than one view-point, that, namely, directly in front, but no objection was made to orientation in imagination if the subject seemed impelled to so vary its meaning to himself. This was allowed for the sufficient reason that with characters so full of suggestive meaning as are many blots of ink it is impossible to prevent their adjustments in imagination without disturbing deeply the judging and selecting process. On this matter of position lay one of the interests of the experiments, for, in the complexity of psychic association, to turn a blot a few circular degrees is often to make it seem an entirely different object with quite different meaning for a particular percipient.

Altogether, about nine hundred judgments were recorded and explained, the details of these explanations from introspection on a basis of precise objective stimulus constituting an interesting study in themselves, which here we shall not touch upon. We shall be content to indicate the general nature of the judgments as a whole and the principles of likeness and unlikeness which these judgments,

so far as they go, empirically demonstrate in the range of the experiments.

The nature of the apparatus employed is obviously such that statistical results are for the most part of little use and photographic reports of the judgments made would have to be so numerous as to be impracticable. Careful and extended study and comparison of the sets of blots selected by the various subjects, however, brings out several striking facts as to the mental process concerned, the most interesting of which are as follows:

The average size of these visual objects was such that ocular contour-movements probably were not much concerned in perceiving them. The projections, to be sure, tend after a while to be counted in an indefinite sort of way and their general shapes and directions noted. The blots are, however, too small to need outlining and are at once apprehended as units, just as are long words familiar to us. Be that as it may, the most conspicuous criterion of likeness and of unlikeness alike in these selections was what we may call relative massiveness. If the norm-blot happened to be noted as massive or as attenuated or as a mixture of these two, selection was made accordingly. This appears continually in the results of the experiments. This difference was noted immediately in practically all the cases where animal associations did not occur, thus crowding it out. It implies, apparently, a fundamental criterion in comparison-judgments of form and gets its bodily basis in the relative number of retinal local signs bunched in the perception, rather than in ocular contour-movements. This is apparently the most conspicuous of the sorts of "change of consciousness" which underlie our apprehension of likeness and unlikeness.

Another result of these judgments appears to be our excessive dependence on language-concepts for a clear awareness even of pure form. In almost every case the choices had their criteria of sameness or of difference sharply defined in words, expressed or not, of the subject. However pragmatic in their life-philosophy, all these subjects save one were obviously strong conceptualists. They made no progress in characterizing the norm-blot to themselves until words had arisen in their minds to make its character or characters definite and sharp. The sensational basis of the apperceiving process (a mass of retinal local signs plus a tendency to contour-movements) by itself led to no clear apperception of the blots. Whatever the confused experiences might be on perception of the blots, there was no clear notion of likeness or of unlikeness, no decided change in consciousness, until ideation had had its say. This would probably not be looked for in a set of subjects outside of college influence, where ideation is taught too often as the end-all and the be-all here.

Indeed, the only subject who claimed to have a true *feeling* of likeness and of unlikeness was a student of music, naïve enough as a student of psychology. He, too, had the concepts associated with the respective blots, but he avowed a distinct feeling of similarity and of dissimilarity which persisted. It needs only a glance at the sets of blots chosen by him and compared with those of others to show that his choices were by far the most satisfactory of all the subjects' sets. The explanation is not afar off: Exen these simple bluish-black forms in only two dimensions have so many characters that to specify one, or two, or three, and compare them by these leads to imperfect and misleading results. On the other hand, the "feeling" of likeness or of unlikeness implies a much wider acquaintance with the blots and is, therefore, the basis of a better comparison. Related here is obviously an important educational principle which he who runs may read.

These experiments, again, illustrate the high stage which symbolism has reached in our social mental process. In nearly every case the subject found difficulty in inhibiting the reproductive imagination of animals, starting from the norm and extending to the blots chosen as like or unlike it. This process was interesting, but, being foreign to the topic in hand, was excluded because it led to comparisons obviously artificial. It was, however, often only with difficulty that most of the subjects could be induced to perceive the characters as mere chance-blots of ink, as masses of black color filling in an absolutely meaningless outline on a bit of white paper. If this inhibition were not insisted on (as at first it was not) the subject compared imagined animals rather than blots. One man, for example, promptly said the norm was a bird and thereupon chose ten "birds" flying, standing, roosting, swimming, swans and eagles, storks and humming-birds. However, it was not difficult for the subjects to overcome this symbolic menagerie-habit, so to say, and to use other criteria than those suggested by the associative imagination.

The two preceding results from these simple experiments (namely, the highly conceptual, and highly symbolic, characters of the class of perceptions here concerned) lead to suggestions as to the subjectivity of likeness as a mental fact. One thinks of Bradley's surprising collection of "objects that do not exist" when one sees how various are the qualities ascribed to this set of objects. As a matter of fact, these differ, for the most part, only in mere outline, by which they may be arranged as like or as unlike. One tends *pro tanto* to lose faith in mere ideas raised in the idea-overburdened mind when out of a hundred blots compared with a norm one sees seventy-one chosen as "similar" to it. Three blots were chosen by each of seven subjects, one by six subjects, six by five subjects, seven by four sub-

jects, ten by three, sixteen blots by two subjects, and twenty-six by only one subject—these numbers applying to one norm, but being of average sizes. When one lay out the sets chosen by the concept-criteria the differences in the blots often struck him more forcibly than did their sameness. Yet each subject had all the time he wished for his selection and made a deliberate choice, as deliberate at least as real life would usually allow of his making in comparing actual experiences. Only very rarely, moreover, would the actual objective similarity in life be as narrowly confined as in the conditions of these simple experiments.

Within the number of those subjects who chose their similar and dissimilar blots by ideal (rather than by affective) criteria, there is a considerable range of formal accuracy, dependent on the ideas employed. Some ideal criteria were obviously more essential than others and led to the selection of a set of blots evidently like each other and the norm. Ideal criteria gave more accurate results in the dissimilarity choices than in the similarity choices. This is, as we should expect, on logical principles. The awareness of unlikeness is an easier, if not a simpler, process apparently than that of likeness, for the change of consciousness is greater and so easier to appreciate. At any rate, the sets of blots chosen as unlike the norm were much more certainly unlike it than were the "similar" blots chosen like it.

As we pass, it is not improper to note the indirect evidence afforded by these experimental results of the motivity of even conceptual consciousness. Ignoring the larger questions as to understanding, there is here ample illustration that such a cognitional process as the comparison of bidimensional forms does not ordinarily find issue until the actual *word* symbolic of a concept is fairly clear in consciousness. If it gives the subject the impression that it "appears" out of his vague subconsciousness (as often is the case) that is another problem that need have here no further mention. This conscious-becoming of an actual word can mean nothing else, it seems, than the innervation of those muscles and glands whose proper coordination would utter the word. Such dependence of an intellectual process as general as that of a judgment of likeness or of unlikeness upon the activity of the neuromuscular mechanism of speech is not any too frequently at hand. Here it can be taken for what it is worth in the doctrine of the relations of body and mind.

Were we to summarize and fuse the notions inductively suggested by this little research we could emphasize that judgments of bidimensional forms, when not geometric, are more accurately made by "feeling"-criteria than by conceptual criteria. The subjects who paid most attention to the actual visual sensations (retinal and oculomotor) as objectified in *looking at* the blots instead of *thinking about*

them, made the best, that is, most similar and most dissimilar, selections. The former in choosing similar forms kept the change of consciousness at a minimum by their method, for they retained in mind a more or less true image of the norm. The latter, the conceptualists, on the contrary (but only after innervating for the word), replaced the original visual image with a more or less partial concept and repeated it in their choices, but more or less forgot meanwhile the shape of the norm. The practical application of this principle, familiar to psychologists, to affairs, for example in the taking and evaluation of evidence in legal trials, should not be further delayed, especially since rather numerous researches along various similar lines (that of Cattell, for example) have all pointed to the same really important fact that what we see or hear or feel is often determined as much from within as from without ourselves.

Another result of this work that may be mentioned is its emphasis on the practical value of affective impressions in comparison with knowledge that is purely cognitional. It is outside of the experimental results somewhat, of course, but it may be strongly believed that this principle is continually acting often to our disadvantage, and especially in education, in our relations with our generally experienced environment, and with each other. As demonstrably here, the learning mind, through too little attention to this matter, is led frequently to errors that might be often avoided did it allow greater and more nearly natural freedom to the sensational and especially to the affective aspects of our mental process. In education we are undoubtedly apt to overdo ideation and to underdo the affective phases of the developing mind. Greater objective activity in the free realms of feeling and less reliance on the "apperception-mass" would surely lead the child to see things as they are rather than as a more or less formal and hereditary association of ideas compels him to think them.

The one other result that appears most noteworthy of those suggested by this work is its evidence for the neuromuscular basis of conceptualization—evidence coming, it is true, perhaps not less from within than from without! These chance-characters as a rule have in them a minimum certainty of conceptual symbolism—that is, on the average, they are about as far away in shape from language-symbols as any forms that could be devised. None the less, as we have seen, they usually start some conceptual associations, more often, on the whole, than trains of imagination, and they start these associations, so to say, without a push, without giving them more than the needful minimum of bias in any one direction—they introduce the energy but do not guide its course. Under these circumstances the association-time and especially the wholly subconscious start is

very long oftentimes. Often, as we have seen, the consciousness was to introspection a mere confused and scarcely conscious jumble of more or less unpleasant strains in and about the head, eventuating, however, sooner or later in a *word* clearly thought or even spoken aloud. In the usual form of word-association measurements, in the formerly so numerous researches on reaction-time, the symbol used as a stimulus was either a printed or a spoken language-symbol and therefore in the closest cerebral connection with the muscular innervations, etc., of language-expression as developed in the brain when the individual learned to understand and speak and write. In these cases, on the other hand, the stimuli were no such familiar symbols, practically part of the language-expression mechanism, but were rather almost unrelated stimuli, abstract, so to say, rather than concrete. None the less, after a time the speech-innervations were suitably set going.

It is hard to believe that this difficulty of language-association under these circumstances is other than the difficulty of making "new" pathways, combinations, in the expression-neurones of the brain. This means, probably, each time a new struggle through unaccustomed innervations of speech-muscles. There is apparently no other neurologic basis for the confusion and the delay. These last were both experiences unpleasant to the subject and tended, therefore, to be eliminated by repetition and habit, if it were possible; yet they were neither eliminated nor much shortened, at least within the limits of these experiments. Neurologically this is interesting, this slow and unpleasant fumbling around of a sense-impression among the infinite possibilities of cortical (and nuclear?) routes. It is interesting, too, in a broader way, philological and psychological, in so far as it suggests that, in the human mind as of old in the great empire, all roads, even the most unlikely trail of a chance ink-blot form, lead sooner or later into the (mostly muscular and epithelial) innervations of language-expression—the one function characteristic of humanity. As has already been suggested, these stimuli were as far as possible from language-symbols of any language, and the outcome of the association-process was, therefore, all the more striking and suggestive, however inferior the determination of likeness and unlikeness by this process as compared with the few cases where the cerebral association remained of the affective aspect.

Recent advancement in biochemistry and especially in neurometabolism has made possible suggestions more definite by far than ever before as to the real nature in scientific terms of these innumerable influences darting through the cerebral maze that psychologically we discuss as subconscious associations. However interesting, however, such speculations may be, the broader questions

as to the relationship of mental "energies" to the forces we know as chemic and electric must outweigh in interest the purely physiologic problem. How can we designate for proximate scientific use the ultimate nature of the neurogram, the memory-trace, the endless and perhaps ineffaceable "vestigia" of ever unique experiences? And if we could and did "connote" them, should we not forthwith find it quite impossible to discriminate the energies we described from the thing we speak of as consciousness, with its sthenic and asthenic conditions, its dynamogeny, its varying qualities and quantities and durations, and the other numerous characters which it shares with the "somewhats" that even the avowed dualist (if he truly exists still) speaks of as energies? In fine, then, why do we not give up this two-faced terminology of a bygone time and speak the straight language that leads to clear thinking and to real knowledge in terms that are ultimate? To the present writer it is unknown what proportion in general of the psychologically informed consider that ideation (as well as feeling and willing) is immediately interknit with ("dependent on") the innervation of the muscles and glands that would express the concerned ideas. One would almost assume that nearly all psychologists who know their physiology fairly well (they are none too numerous) would nowadays thus presume the basis of thought, for gradually the psychophysiologic chasm is narrowing, or, at least, many firm bridges are being thrown across it; perhaps before we fully realize it we shall look in vain for the chasm itself!

However all this may be (the "physiology" of ideation and thought), here in this little research is adequate evidence, so far as it goes, that an idea comes plainly "into the mind," that it becomes clearly conscious, only with definite innervation and more or less deliberate and complete occurrence of the muscular movements that would express the concept in words. One can dimly *feel* the similarity or dissimilarity between two chance shapes, but in most persons, too many, perhaps, the feeling is useless and even oppressive, until definitely expressible in neuromuscular terms more definite and distinct than those of a feeling-tone: that is, articulated.

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A PHASE OF THE PROBLEM OF CONTINGENCY

THE aim of this paper is to discuss a phase of the very old problem of contingency; not the contingency of the acts of the individual man as such, but one sub-case of what might be called cosmic contingency. The precise problem will, I hope, be made clear as we proceed.

On the one hand, it is desired to admit and use universal natural law, but on the other to find, if possible, an escape from the *nec quando nec ante nec post, sub specie æternitatis* point of view which Spinoza took to be the logical outcome of his determinism. It is desired in this paper to accept determination in the fact of eventuation, but not before that fact. In other words, the writer objects to the position that determination, definite and final, exists antecedent to the act of eventuation. His thesis is that such determination antecedent to the fact is shown only for a closed situation, a finite universe; and that, accordingly, the logical process whereby the mind has historically gone to a universal and all-inclusive system of antecedent determination is blocked, if the actual universe be conceived as quantitatively infinite.

The program as stated is a problem of ethics or perhaps more exactly of philosophy as philosophy essays to mediate in the conflict between a certain extension of physical science on the one hand and an apparently essential demand of ethics and practical life on the other. But, although the problem is philosophical, the discussion will be more scientific, because the writer believes that the assertion of the above-mentioned extension of law is scientifically neither necessary nor justifiable.

One who fixes his attention on natural scientific explanation easily becomes so enamored of the certainty with which "effect" follows "cause" as to feel that in this uniform and invariable succession there does lie and must lie the key to "the riddle of the universe." At least so far as the riddle can properly be put for solution, and so far as a key may wisely be sought. Especially does this key appear to be the true and only one in proportion as it enables the student of nature to foretell future eventuation, whether in the artificially devised experiment of the laboratory or in the observation of naturally occurring phenomena. This line of thought might be developed somewhat as follows.

If it be true that each event finds its entire character determined exactly by previous events, then a knowledge of those previous events and the general operations of nature would enable us to foretell exactly the entire character of the event in question. We do not now

ask whether human ability shall ever be equal to such a task; the present point is that the character of the event is completely determined in advance of eventuation, and, under certain ideal, even if unattainable, conditions, could have been foretold. Any event that is thus exactly determined by a set of conditions is *actually* determined as to both its character and occurrence as soon as the determining conditions are themselves exactly and exclusively determined, and this is true even though time must elapse before the determined event becomes actual. In this sense the event may be said to exist potentially in its determining conditions. If, then, the state of affairs S_2 exists thus potentially in the state of affairs S_1 and S_3 similarly in S_2, does it not also follow that S_3 exists in the same way in S_1, and so for all succeeding S's? That is, this line of reasoning seems to make us conclude that in the present is contained even now the whole future, determined in minutest detail both as to character and as to occurrence.

When these implications begin to take hold of one, interest somehow seems to shift from the long-drawn-out process and its unfolding to the formula which implicitly contains the whole. If we choose to use an unphilosophical expression, God has the formula and sees all things as present. Spinoza, who thought much along this line, applied the word eternity to the timelessness of the formula, asserting that "in eternity there is no when, no before, and no after." For him "imagination" may see things *sub duratione,* but "intellect" and "reason" must see them *sub specie æternitatis.* Naturally and necessarily, he goes on to deny any objective reality to contingency or possibility. They exist only relatively to man's ignorance.

But our introduction is, perhaps, already too long. Repeating from the first page, what we wish to establish is that final and exact determination prior to the event is shown only in and for such a closed and finite situation and universe as is substantially different from what science assumes our actual universe to be. In the discussion of this, let us first assume that the situation out of which any event has grown is separable into mathematically distinct elements. Later we shall reject this limitation and repeat in part the consideration.

1. It will be convenient to divide again this case of mathematically distinct elements into two sub-cases, according as the number of elements are or are not numerically infinite.[1] We consider the former first.

(1) The conditions given in this case seem to me to be such as to

[1] I use the word infinite here and elsewhere throughout the paper, in the mathematical sense, to indicate, that is, such a variable number as may surpass any arbitrarily assigned number, however great.

lead undoubtedly to predeterminism of the complete type. The uniformity of nature, assumed throughout our discussion, can not mean less than that, any set of conditions being given, the next succeeding event is uniquely determined. To fix ideas, let us suppose that the universe, for this case, is composed of exactly six mathematically distinct elements. For my part, I can not but think that mathematics itself, or something very like it, would express for us the whole subsequent history of such a system. An inclusive uniformity of nature would certainly mean that the next succeeding state of affairs would be uniquely fixed in the case of the given simple system of six elements. Whether mathematics would fail, as in the problem of three bodies, to tell us the solution has no bearing on our point. The resulting status would be fixed whether or not we could previse or predict it. And if this would be true, for the next succeeding state of affairs, we have again the discussion of the *S*'s as given above. All succeeding states and movements of the system would be included potentially in the given conditions. All the future of such a system would be included in one formulation. Spinoza's world view would hold. True reason would see things *sub specie æternitatis.*

And if this be true for a system of six elements, it would be quite as true for one of sixty or six thousand or six million. So long as the number of elements is fixed, one all-inclusive formula contains the whole future[2] history of the system.

(2) But if we have an infinite number of elements, the situation appears very different. As I see it, we can not longer say that the conditions which determine any (arbitrarily chosen) event are fixed in advance of the actual eventuation. As this is the crux of the whole argument, we may with propriety dwell on the consideration of this point.

An illustration may help. Consider Halley's comet. The astronomer tells us in justifiable shorthand that this comet will reappear in 1985. Does he mean to assert this absolutely? By no means. Three possible "contingencies" prevent the absolute assertion: (*a*) the calculation may be incorrectly made; (*b*) the data existing within our solar system may not all have been taken into account; (*c*) some additional body, another comet, or a "dead sun" may "enter" our system to disturb the existing conditions. The first two contingencies do not here interest us, the third is vital to our discussion. How shall we deal with it? The astronomer would doubtless say that if

[2] Although I have used in this discussion such expressions as *the future, subsequent history, next succeeding,* it is not to be understood that such terms with their ordinary content would be applicable to the assumed system. Their inaptness in the description is a part of the *reductio ad absurdum* of the assumption.

only he could have been given, sufficiently in advance, the data of the new body, its effect would have been included, and so we agree. What is then the new situation? The solar system is larger by the new body. The determination in the larger system is exactly as definite as it was in the smaller system, and no more so. The comet is now scheduled for, say, 1990. Will it come on time? Again the same three "contingencies" present themselves. Apparently this method of inquiry leads to an infinite regress.

Suppose we take another line of procedure. In the paragraph just concluded we seemed to be asking about foretelling, let us now confine our attention exclusively to fore-determination and ask: At what stage in the comet's history is the date for the next appearing, in fact, determined? Perhaps some more trivial instances may lead us to the answer. One sets an alarm clock to awaken him at six in the morning. The time of its going off is, we say, fixed the night before by the proper adjustment of the machinery. The event is, barring "accidents," determined thus considerably in advance of the eventuation. A miner sets a slow fuse. At what point in the process is the time for the explosion fixed? The structure of the fuse, the length cut off, the general arrangements, the time when the fuse is lit—such are some of the factors that enter into the determination of the event and accordingly of its date. With a modification later to be made, we seem to be authorized to say that as soon as the conditions for an explosion are arranged in place, the time and character of the explosion are fixed. Or more exactly, the results and the time necessary to intervene are fixed, each and all, finally and uniquely, just so soon as the determining conditions are in final and exclusive possession of the field of operations.

But when are the determining conditions in exclusive possession of the field? In the case of the explosion this can only be after the arrangements are made and no outside interference is possible. But with man a factor, the problem takes a turn that we do not care now to follow out. Let us then return to the consideration of the comet. When are the determining factors of its appearing in finally exclusive possession of the field? The terms "determining factors" and "exclusive possession" alike and together point to the same consideration that we had above of possible "additional" elements, with a like fall into the infinite regress. With an infinity[3] to draw from, at any particular instant of time an additional element may "enter" into any assumed system, however large. However large the system be conceived, there is nothing within which shall limit the "determining factors" to the elements already within the system at the given time. Or, to use the other term, never can it be said that

[3] This is assumed throughout the paper.

finally "exclusive possession" prior to eventuation belongs to any given set of conditions. Since, then, any given system is liable to inference from what is immediately without, no inner determination of the result is final apart from a consideration of what is without; and since on our assumption there is no end to what is without, there is no limit to this ever-widening of the area of determination. The infinite regress that we found previously repeats itself here.

2. There remains now for consideration the other case in which we should no longer assume that the determining situation is decomposable into distinct elements. There appears no reason to doubt an equal applicability of the same line of reasoning. In the actual world there is no such separateness and atomism of "things" and "forces" as our vocabulary, following common sense, would imply. But the inaccurate speech so far used does not, I think, take any advantage of the position here controverted. Indeed, in the writer's own experience it was in connection with the more fluid view of things that the position here advocated came to mind.

It may be remarked a certain suspicion naturally, and probably justly, attaches to discussions in which the mathematical infinity plays an important rôle. Zeno and many less capable followers have left the warning sign of danger against this. The writer feels, however, that in the present case he is but tracking the steps of those whose position he attacks; and this to show that it is they, and not he, who have misused the concept. They have found determination to exist antecedent to the fact in certain finite and isolated systems, and have unwarrantably extended that concept to apply to situations infinite in both time and space. The writer's use of the mathematical infinity is but the pointing out of their misuse of it.

The scientific method has been devised with reference to control, and control depends on determination antecedent to the eventuation; but there is here no criticism of the scientific method properly understood. Science takes a world which is (apparently) infinite and not (exactly) decomposable into distinct elements, and by abstraction simplifies this actual world into an ideal world wherein are a finite number of distinct elements. Its conclusions, thus consciously hypothetical, are conditioned always on the assumptions (1) that the situation is adequately analyzed and (2) that all the factors are included. With growth of knowledge comes growth of this ideal world, *i. e.*, more factors are included in the consideration. With each such addition the ideal world accords more nearly with the actual by an amount equal to the influence of the added factor. Always the ideal (for the time being) is finite and accordingly predeterminism does reign in it. But if the actual world be infinite, the

addition of factors to the ideal world will be an endless process, and the ideal world can never coincide in all points with the actual.

In conclusion, any event is thus determined to be what it is in every detail by the conditions that are on hand at the time of eventuation. Looking at the present and past, determination is always discernible to appropriate scrutiny. Looking ahead, there is only the approximate determination such as we know in science. To speak absolutely, any event is finally and exactly determined only in the fact of actual eventuation.

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CHANCE AS A CATEGORY OF SCIENCE

TERMS slip easily from popular usage into the technical vocabulary of logic. We often employ the word *chance* as a general synonym of ignorance, while science has accepted a usage which makes chance the antithesis of law. There arises, therefore, the problem of the nature of chance as a category of thought, for upon a distinct and unequivocal interpretation of the term depends alone its legitimate use in science.

There are two possible attitudes we may assume regarding the concept of chance. On the one hand, we may look upon a usage which simply passes over the logical issues and regards chance as merely a shroud for obscuring our veritable ignorance of the true causes of an event. Such a point of view makes chance subjective. On the other hand, we may regard the term as indicating a serviceable, scientific concept, having a significance in the logic of the sciences, a significance which gives chance a distinct and definable value. This point of view makes chance objective.

The usage of chance which makes it depend solely on human ignorance is the immediate postulate of a metaphysical assumption. If we presume, as a fact of reality, that law and order are universal throughout nature, then nothing ever occurs by chance, but is the immediate result of definable laws. If, with this in mind, we speak of the chance occurrence of an event we simply imply that we fail to comprehend the laws upon which the event depends, although we recognize that somewhere in the vast totality of nature's order the event would find an adequate and full explanation. There is no chance from the point of view of the absolute; the postulate of the ultimate uniformity of nature destroys chance with one stroke of the pen and makes all lapse of regularity the lapse of human knowledge.

But this brushing away of chance from our speech is merely a postulate of a deeper metaphysical theory. It has not touched the problem of its logical value as a scientific category. The fact remains, over and above the postulate of absolute law, that science and the demands of our ordinary speech require a concept that shall express the permanent doubt of an event, whatsoever our ultimate world-formula may be. Five red balls and five black balls are in a bag. From the arrangement of the balls, the folds of the bag, the movement of my fingers, and the configuration of the dendrites of my brain, it may be determined in an absolute sense which ball I first draw out, but these considerations are not part of the immediate circumstances at issue. We want a term which shall express the indeterminate character of the forthcoming event. That term is chance. Science demands its employment in a thousand instances, and the logic of the sciences must prescribe a usage which makes it legitimate. And all this without any reference to absolute law and regularity.

The problem of chance is not concerned with the organization and uniformity of all nature, for the simple reason that no scientific problem ever embraces the universe. The chemist must deal with the molecular constitution of quartz without discussing the period of the earth's history in which the quartz congealed, nor the seismic convulsions which accompanied its formation. In an absolute sense all knowledge may be relative—that is a metaphysical issue—but in the precise sense of a scientific investigation all the facts of the problem are restricted to a limitable universe of discourse. In these definite confines chance arises. It can, therefore, have an objective and valid meaning in a world ultimately causal and sequential, simply because the scientific problem in which chance occurs is not the problem of all human knowledge. We may accept or reject the metaphysical premise of an absolute world-order, where at the last extremity all is law and nothing chance. Nevertheless, the logical problem remains.

Chance is bound up with certain types of scientific categories which enable us to describe experiences. In describing experience we must first limit it. When DeVries speaks of the occurrence of a mutant or sport variety of a species as the result of chance, he is contrasting chance with law in the limited sphere of germ cells, inheritable characters and similar biological phenomena. McDougall's observations that the occurrence of mutants can be influenced by salt solutions is a chemical fact not included originally in the definitely limited universe of discourse in which the chance mutant may be said to occur. This chemical fact may be added to the original universe of discourse of germ cells and inheritable characters

by enlarging it by just so much. The fact remains, however, that the universe of discourse, in which the chance mutant occurs is, to the minds of the students of genetics, limited and precise.

This limiting of the sphere of a scientific problem determines the solution of the problem. If the biologist so defines the problem of heredity that chemical phenomena are excluded from its definite boundaries, then chemistry can have no effect on the solution which the biologist ultimately reaches. It is out of the matter by arbitrary exclusion. Of course, a scientist will make his original universe of discourse as large as he deems necessary, but it will always remain arbitrary and determined, simply because it can not include all nature. It must be small to be workable. It must be precise to be thoroughly understood.

This determines for each scientific problem a limited horizon within which the conditions of solution are supposed to lie. The labor in solving the problem is the labor of categorizing and systematizing the facts within this limited universe of discourse. And a solution arises when some regularity is observable. We call that observed regularity a law. When no observed regularity is evident, one event happening apparently without sequential relations to other events of the universe of discourse, we may call the occurrence of that event *chance*. It is, therefore, merely the absence of sequential regularity within the universe of discourse of the problem.

According to this interpretation, law is the successful reduction to some principle of order of certain phenomena within a limited universe of discourse. Chance arises when no regularity is observable. The occurrence of a mutant in the limited universe of discourse with which DeVries and other biologists deal in their problems of genetics is a chance occurrence simply because these biologists are unable to discover any regularity underlying the occurrence of such phenomena. Were the universe of discourse to be much enlarged, say by the introduction of many chemical and physical facts, it is possible that what now appears as chance would then become law. But for the universe of discourse at present considered the event can only be explained in terms of chance. This theory of chance, therefore, makes chance and law relative terms dependent upon the extent of the universe of discourse within which the scientist hopes to solve his problem.

Such a theory of chance indicates that the step between chance and law may depend on nothing more vital than the limits by which the problem was originally circumscribed. Chance and law are not antitheses of one another, but simply terms which are relative to the success or lack of success with which we find regularity in the universe of discourse of any scientific problem. Moreover, the

occurrence of a chance event may be explained without denying the general uniformity of nature, for it would be observed that the process of reducing chance to law is a process of discovering the two sets of conditions, within and without the definite universe of discourse, upon which it depends. Let a represent the occurrence of a chance event, such as the drawing of a black ball or the occurrence of a mutant. Let $a, b, c \ldots$ represent the conditions within the immediate universe of discourse of the problem. For example, in the case of a mutant they are conditions inherent in the structure of the germ cells and the like, which the biologist is bound to take into consideration. And let $m, n, o \ldots$ be certain external conditions without the universe of discourse; in the example in question they are those conditions which the biologist has not deemed worthy of considering, as for instance, the effect of atmosphere and chemicals upon germ cells. Chance would be represented by the formula $a = f(a, b, c \ldots m, n, o \ldots)$. Then according to this formula, the chance event a becomes a function of these two separate sets of conditions, the one confined entirely to the universe of discourse of the problem, and the other set lying without it. The reduction of chance to law consists in the determination of such values for $a, b, c \ldots$ and $m, n, o \ldots$ as to bring regularity into such a new universe of discourse as will include all these conditions.

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REVIEWS AND ABSTRACTS OF LITERATURE

Psychology and the Teacher. HUGO MÜNSTERBERG. New York: D. Appleton & Co. 1909. Pp. 325.

Part I. In this age of pedagogical unrest, Münsterberg welcomes the possibility of a more intimate connection of laboratory psychology with schoolroom operations. The unpardonable sins of pedagogy have been vagueness and failure to utilize the most vital psychological discoveries, chiefly because of the lack of articulate ideals of the end in view. Laws of attention, memory, or interest, though true, may not necessarily be pertinent to educational situations. No facts *per se* yield educational guidance. Practical pedagogics, for example, becomes vicious when a wholesale carrying-over of laws of interest results. The foolish inference in this classic example of pedagogical fallacy is that we must let the child *illustrate* the psychological laws of interest, thereby bringing about chaos of aims and subversion of sound development.

An ethical inquiry, then, must supplement a psychological one. From the points of view of biology, psychology, and sociology we may analyze the processes and discover suitable methods of procedure, but science as

science actually transforms, does not copy, reality. Ethics, portraying human relationships and whole purposes in action, occupies the realm in which vital pedagogy must move.

The author, now in the field of ethics, scores standards based on hedonism, suggesting that our off-springing pedagogy of interest sets a mean goal and offers a cheap and superficial task. We must find then in a sort of dynamism true values beyond reference to a personal state, for which, too, we can naturally strive. Here the author implies his whole philosophy of *eternal values,* only the most literal drift of which the average reader will take in. He does, however, exhort with the threat that he who does otherwise than this in education "prostitutes his personality." On this basis education is not an affair of mere morality any more than one of mere art or religion or logic. And though the personal factor may enter into one's categories of goals of worth, still "superpersonal absolute values for all life" alone can make unity of purpose and integrity of attitude for the teacher. Clearly ethics furnishes the aim.

Part II. As to the method educational psychology is in an apparent dilemma. The humane emotional attitude of personal intercourse is interpretive and appreciative, the impersonal attitude of science is literally descriptive and causally explanatory. Must the teacher shift his point of view, or rather grow securely in the former? The author apparently concludes that the teacher, in so far as he is to be a conscious psychologist, is limited to the crude and clumsy use of facts brought bodily and literally over from the "scientific" field to the field of "real life." There is a suggestion here that clarity of science, even of psychological science, stands opposed to the natural-life point of view, however significant and rich this is. As to systematic psychology, Münsterberg makes slight use of, indeed scarcely fathers, his former sensationalistic or one-element theory. Elementary psychology of some sort, however, must be adopted to supplant faculty psychology and to reveal the "bewildering manifoldness" of all mental processes. To offset this impending confusion a biological view-point will restore the unity by conceiving the nervous system as essentially a reacting not an absorbing, machinery. Experiences, to be vivid, and hence efficacious, must fit in with action. In this sense the student is a motor apparatus.

With this setting the author devotes eight chapters to a discussion of specific mental operations or factors, apperception, memory, association, attention, imitation and suggestion, will and habit, feeling, and individual differences in general. His chapter scheme is to discuss the notable genetic stages, the common individual differences including sex differences, the typical pertinent experimental results, suggestions as to how to investigate further, and the desirable and possible applications to school work, such as adjusting teaching to the inevitable childhood stages, etc. He is consistently and convincingly motor throughout, both in his psychology and in his pedagogy. Aside from this general schematic treatment in each chapter, a few points seem to be happily emphasized. In training in memorizing, for example, we are apt to forget the necessary "settling" or "absorption" period, as well as the different prin-

ciples governing "first learning" and "real keeping in mind." So the teacher, after he has discovered the various types under his charge, and incidentally noted his own peculiarities, should be wary of imposing his own or any other one method upon all types. A knowledge of individual differences necessarily makes teaching more intelligible, though the inevitableness of just such a situation in itself in no sense calls for a segregation of types. And again, though one utilize involuntary attention, it should be with a view to the later persistent training in effortful concentration. Formal training is a fact, training of the will being formal even when the development in question may be specific. Feeling being motor reaction, there is no emotion which can not be educated. Induce the type-action, and you tend to engender the emotion. An abnormal emotional life is a life of obstructed activities.

Part III. The work of the school consists in instruction about things, people, and self, and in inspiration in regard to our "emotional willingness" in the activities which relate themselves to harmonies, perfection, progress, idealism, human solidarity, reverence, and truth. The problem of the curriculum is to effect these two purposes, paying due regard to the student's limitations as to quantity and quality of matter, and to the social democratic pressure, and to the "almost immoral lack of support from the home." In the interests of "the unity of a national education" no shallow concessions to the psychological doctrine of interest and the philosophical doctrine of individualism—such concessions as is the elective system—should be allowed. It is impossible, with such a policy dominating, to train voluntary attention. The author next devotes a chapter each to elementary and to higher studies, suggesting the distinctive educational disciplines, and incidentally announcing a later treatise on "psychological didactics." As regards high-school subjects he deprecates the neglect of "conceptional" knowledge and training, the fact of our "æsthetic obtuseness," and the intrusion of industrial education into the wrong place in our school programs, as well as the low estate of the classics.

As to organization, we need condensation, sex adjustment, social adjustment, a reconsideration of coeducation and of the elective system, some real discipline, more "psychological" recess periods, more imaginative activity and general mentality in play and games, a principle for directing home study, and home cooperation which is "more important than taxes." The standard qualification for teachers should include the possession of emotional temperaments of discernment, a mastery of subject-matter, and a professional preparation, which last, as at present offered, generally needs to be supplemented by ethical training. Lastly, the school should try to win back the male teacher.

The tone of the book is hortatory as well as analytic, combining pretty well, or at times shifting skillfully and easily from one attitude to the other of those the author has so vividly contrasted. The discussions of elements and parallelism seem forcibly drawn into the treatment. There is needless repetition too schematically presented. Many slaps at imaginary absurd pedagogists lessen the force and detract from the tone of integrity

of the presentation. The author has overworked the distinction, for practical purposes, of facts and purposes, assuming and then too easily settling an artificial epistemological question. There is an unfortunate savor of the doctrinaire. The book seems academic. It arouses the suspicion of a lurking individual philosophical system which, as with Spencer, must be, "illustrated" by the educative process. The other sharp distinction—between a thing eternally valuable in itself and another that merely brings pleasure—just as the above distinction of one which possesses intellectual clarity and another that has merely emotional richness still further accentuates the mechanical compartmental aspect of the work as a whole.

On the other hand, the book is to be commended for its high educational aim clearly and boldly stated and consistently defended. The author's insistence that we supplement psychological inquiries with ethical ones should set departments of education and teachers' colleges to work upon the problem, already being definitely faced by France and Japan, for example, of how to raise the present standard for certification of teachers in this specific direction. The work is broken up into twenty-nine short chapters which are rich in their suggestiveness. The author has apparently settled so many, until quite recently at least, highly controversial problems of formal discipline, of memory, of attention, of feeling, etc., that the critical reader will scarcely be persuaded, particularly when all the authoritative sources remain unmentioned. If, however, the purpose of the book is rather the elementary and popular one of conveying to the ordinary teacher the mere fact of the "bewildering manifoldness" of mental life, it succeeds consistently chapter by chapter. One of the good features of this psychological part of the book is just this, that, though each chapter-ending is tantalizingly inconclusive, still suggestions, hinted at rather than clearly outlined, of pertinent lines of experimentation, abound. The average young teacher of educational psychology and the better-than-average public-school teacher needs more. Again, as I have already found with the book in a class of fifty-seven prospective teachers unacquainted with Münsterberg's philosophical characteristics, the most literal and trite inferences from his ethical discussions and implications are drawn. This suggests that writers of treatises for teachers should possibly put only in the background, if anywhere, personal predilections for a particular rigid philosophical system. Common words used technically by this author, such as "causal relation," "description," "explanation," "appreciation," "will attitude," "values," etc., presuppose a good deal, and the average reader, student, or teacher is nonplussed by them. Sentence structure of a sort of adapted German idiom with the consequent grammatical irregularities increases the difficulties. The following are typical examples. "All which makes the child willing for the work" (p. 243). "We may be short as we have approached this field once . . ." (p. 244). "Whether artistic drawing or singing are studied" (p. 247), etc. To offset such obstacles of approach to his message Münsterberg has at command a style of exposition which is characterized by penetration, incisiveness, wealth of illustration, vigor of purpose, en-

thusiastic confidence in the doctrine unfolded, and directness of application which is often startlingly convincing.

On the whole, this book from a distinguished psychologist should be a welcome addition to one's pedagogical library, force many to resort to experiment to verify or to refute the principles expounded, and, incidentally, prepare the way for the author's more systematic promised treatise on "psychological didactics."

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Clavis Universalis. ARTHUR COLLIER. Edited with Introduction and Notes by ETHEL BOWMAN. Chicago: Open Court Publishing Co. 1909. Pp. xxv + 140. $1.50.

All students of the history of philosophy have reason to be grateful to the editor of this volume, to Professor Calkins, who appears to have inspired the preparation of it, and to the publishing house which has brought it out in a dignified but inexpensive form. The book seems to be an elaboration of a Master's thesis submitted by Miss Bowman at Wellesley College; would that, in the huge annual output of such lucubrations in our graduate schools, one in a score yielded a result so serviceable to the rest of the republic of letters! For Collier's "Clavis," a document of all but the highest interest and consequence in the history of English philosophy, has hitherto been virtually unprocurable. The original edition was already a rarity before the end of the eighteenth century; and Dr. Parr's "Collection of Metaphysical Tracts," 1837, which includes a reprint of the book, is long since out of print, and is accessible, in America, in very few libraries. The present volume gives the text complete, following the edition of Parr, together with a short biographical and historical introduction, and a few pages of notes. The editorial work, in general, has been carefully and competently done; use has been made of Benson's "Memoirs" of Collier, and the clues relating to him, and to his historical influence, to be found in Reid's and Hamilton's references to him, have been followed out, so far as American libraries permit. There are occasional marks of a too mechanical transcription from sources and of carelessness in the matter of proper names. Thus the same Scottish theologian figures as Robert Baron, in the "Notes," and as Baronius, in the "Introduction." Latin names are transferred to the English text in apparent ignorance of their meaning or English equivalents. In a list of writers known to Collier appear "Vincentius, Lirinensis, Suarez"; the first two presumably disguise the name of Vincent of Lerins. "Mogurtiae" and "Marpurgi" seem needlessly archaic ways of referring to Mayence and Marburg. Dugald Stewart's name is regularly misspelled. On the other hand, the "Introduction" probably gives correctly (following Hamilton) the name of the "Professor Eschenbach of Rostock," translator of the "Clavis" into German in 1756, about whom the present reviewer blundered in a paper in "Essays Philosophical and Psychological in Honor of William James" (p. 289). The book is apparently not accessible on this side of the Atlantic; I supposed the translator to be C. E. Eschenbach, professor of

mathematics and anatomy at Rostock, a person of some contemporary celebrity. It appears that there was a more obscure Eschenbach, also of Rostock, bearing the Christian name of Johann Christoph, who was a theologian and metaphysician by trade; to him, seemingly, should be given the credit for making Collier, and Berkeley's "Dialogues," available to German readers.

Miss Bowman seems to me needlessly non-committal on the question of Collier's independence of Berkeley—or even slightly to confuse the question of independence with that of priority (pp. xxii–xxiv). Whether Collier hit upon the idealistic doctrine before Berkeley, may, indeed, be only "doubtful"; the point is, in any case, of small historical significance. But unless Collier's own statement be impeached, as well as several other substantial pieces of evidence, there can be no doubt whatever that the conclusions of the "Clavis" were arrived at long before they were published, and before the author of them knew anything of the speculations which a young Irishman in Dublin was then confiding to his Commonplace Book. And the fact that the two idealists arrived at their opinions independently is of sufficient historical interest to deserve to be unequivocally stated. The "Notes" trace out a number of parallelisms between Collier's and Berkeley's arguments; the value of the volume would have been increased if this had been done in a more complete and systematic manner, and some exact account given of the cases in which the proofs offered logically coincide, those in which Collier supplements Berkeley, and those in which Berkeley supplements Collier. The matters noted, however, are minor imperfections in a useful and well-executed piece of work.

Two results may conceivably follow from a more general acquaintance, on the part of students of philosophy, with Collier's little treatise. One is a certain modification of the usual account of the filiation of ideas in the history of English thought. In Berkeley subjective idealism seemed to emerge chiefly as a consequence of tendencies that owed their vogue largely to the influence of Locke—empiricism, nominalism, the demand for simplification and intellectual parsimony, the desire to set definite bounds to the scope of human knowledge. Berkeley's task is commonly, and not erroneously, represented as consisting in carrying out Locke's task and Locke's presuppositions with greater rigor and consistency; his "New Question," says Fraser, was: "What in reason should we *mean* when with Locke we assume the real existence of 'matter'; and to what sort of power should we refer the phenomena that are present to our senses—if, in the spirit of Locke, we are to be faithful to the facts?" Now, Collier can not be placed in any line of development that runs through Locke. It is scarcely credible that Collier was unacquainted with the "Essay concerning Human Understanding," especially since his friend John Norris wrote a reply to it, 1694; but at all events he was quite uninfluenced by it. Malebranche and Norris for him provided the sufficient basis for idealism. He is, therefore, the chief (though not the only) witness to the fact that Cartesianism of itself tended directly towards idealism; and that this tendency was strengthened and accelerated when the Cartesian

problem of the psycho-physical relation was approached with the presuppositions of a Platonistic epistemology and a Platonistic metaphysics of the absolute. There is, thus, a double line of descent in English idealism; and Berkeley represents (in the main) the cadet branch of the family. This historical fact is, perhaps, not so generally emphasized as it should be. With a fuller recognition of it may come an appreciation of other features of seventeenth-century English Platonism which are not less important in themselves, as types of philosophic doctrine, and are more important as historic influences.

It is not unlikely, also, that teachers of philosophy will make use of parts of the "Clavis" as a means of first introducing undergraduates to idealism in one of its typical historic forms. Collier's English has none of the charm, the ease and urbanity, of Berkeley's style; he is never likely to take rank as an English classic. But if his book is inferior as literature, it is in some respects superior as argumentation, and especially as pedagogy. Compared with the "Principles of Human Knowledge," the "Clavis" has more of the virtues of a good text-book. It begins with explicit definitions and explicit warnings against possible misunderstandings; its arguments are classified, catalogued, and correlated; and it makes less of the alleged sheer meaninglessness of the expression "existence without the mind," and more of the really serious arguments from the antinomies and from the relativity of all sensible properties. Berkeley's mode of approach to his conclusion in the "Principles" usually, I find, produces upon the mind of beginners the impression that he is begging the question from the outset; such an impression is not likely to be produced by the reading of Collier. Finally, Collier does not encumber the argument with the essentially separable question concerning the existence of "abstract ideas." For these reasons, the best historical introduction to idealism would seem to me to consist in selections from the "Clavis" followed by parallel and supplementary passages from Berkeley's "Dialogues."

It is to be hoped that the present welcome volume is the harbinger of a series of new editions of the more important writings of the English Platonists. It is highly discreditable to English and American scholarship that we possess neither modern and accessible editions of the texts of most of these writings, nor any adequate historical study of the movement of thought which they represent. The greatest desideratum here, perhaps, is, first, a volume of judicious selections from the principal epistemological and metaphysical treatises of the Platonists—which should include something of Lord Brook, of More's "Enchiridion Metaphysicum" and "Antidote against Atheism," of Norris's "Reflections" on Locke, his "Theory of the Ideal World" and his "Metaphysical Essay towards the Demonstration of a God," of Collier's "Specimen of True Philosophy," and of Burthogge's three principal writings; and, second, a corresponding volume of selections representing Platonistic ethics, which should include a translation of More's "Enchiridion Ethicum." Until the literature is thus made available, one of the most distinctive, most influential, and most interesting movements in English reflection remains not only virtually unstudied, but also scarcely accessible to study.

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The Psychology of Skill with Special Reference to its Acquisition in Typewriting. W. F. Book. University of Montana Publication Bulletin No. 53, Psychological Series I. 1908. Pp. 188.

The aim of the author is to make a thorough analysis of the conscious processes involved in the acquisition of expert skill in typewriting, and a more complete study of the development and formation of habits than has been offered hitherto. Four observers were trained in the use of an Underwood typewriter; two by touch, with the key-board entirely concealed; and two by the usual sight method. Records were taken on a smoked drum of the number of strokes made on the machine, of the time required for each, and of the observer's pulse variations (temporal artery in front of each ear). A supplementing record of the introspections of the learner and of the comments of the experimenter was also kept.

The following conclusions were reached:

1. Lower order habits develop into those of a higher order by a process of short-circuiting. For example, the several processes antecedent to the striking of a key fuse into a motor-tactual image of the letter which serves to guide the movement. This letter-image in turn gives way to word, and finally to sentence-images as the learner progresses.

2. New habits are always formed wholly unconsciously, and only under great effort and other favorable conditions; but, once formed, they are consciously employed when their advantage has been recognized. The higher order habits develop simultaneously with the lower and depend for their further development on the perfection of the lower. During the perfecting of the groups of habits there occurred in some observers a period of arrest lasting some thirty days. This critical stage appears to mark the time required to overcome certain difficulties encountered in the learning.

3. A close correlation is found to obtain between the pulse rate and improvement, but only when effort is efficiently applied. A supra-normal pulse rate characterizes periods of greatest improvement; a subnormal rate, periods of arrest.

4. Regarding the retention of skill, two tests were made on one observer, each covering a period of ten days; the one, six months, the other, eighteen months, after the close of the regular practise. The first gave a marked decrease in the average number of strokes a day when compared with the average number of the last ten days of regular practise. The second showed an appreciable increase. This result is thought to be due to the disappearance, with the lapse of time, of certain psychophysical difficulties (interfering associations and bad habits of attention) incidentally acquired in the practise. Their removal left the more firmly established typewriting associations unimpeded. The author believes that these interfering tendencies had not disappeared in the six months preceding the first memory test, and that the loss of efficiency was due to the dulling of the typewriting associations.

The reviewer can not make the table on which these results are based coincide with the curve of regular practise. As the curve stands, the second memory test, instead of indicating an average increase of eighty-

five strokes a day as the author tells us, shows a decrease of some fifty strokes from the average attained in the last regular practise, and an increase in the percentage of errors. This result would seem more plausible after so long a lapse of time than an actual increase of skill.

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JOURNALS AND NEW BOOKS

ZEITSCHRIFT FUR PSYCHOLOGIE. November, 11, 1909. *Die Heterophorie und das Gesetz der Identischen Lehrichtungen* (pp. 1–55): PROFESSOR DR. FRANZ HILLEBRAND. – Critical discussion (against Witasek) of the above principles in visual space perception. *Ein Beitrag über die sogenannten Vergleichungen übermerklicher Empfindungsunterschiede* (pp. 56–71): ROSA HEINE. – Confirmation, with daylight adaptation of Fröbes results in which the subjective mean between two brightnesses was found to be higher than the arithmetical mean. When subjects are instructed to judge without the aid of cohesion, the reverse results are obtained. *Die assoziativen Faktoren ein ästhetischen Geniessen* (pp. 71–119): RICHARD MÜLLER-FREINFELS. – For strong artistic reactions not the unprejudiced indifferent consciousness is most favorable, but that in which latent harmonious dispositions already exist. Inner imitation, though not essential, is the best means of reenforcing the esthetic effect of an impression. Animistic interpretations, based on feelings of organic adjustments and innervations, deepen and enrich esthetic reactions to forms, lines, melodies, etc. Artistic enjoyment is of two kinds, depending on the rôle of the "idea of self," (1) as participant or (2) as spectator. *Über die Verschmelzung von Schallreizen* (pp. 119–143): HEINRICH SCHÜSSLER. – The fusion of two or three successive noises (electric spark, sound hammer strokes) is easiest when the strong stimulus is initial, most difficult when faint noises follow each other. When the initial noise is faint groups of three fuse more easily than pairs. Diffused attention favors fusion. *Reviews:* Lipmann, *Über die Möglichkeit einer durch psychische Kräfte bewirkten Änderung der Energieverteilung in einem geschlossenem System;* A. Müller, *Die Psychologie des Unbewussten. Das Unbewusste in der Modernen Psychologie:* A. DREWS. Grünbaum, *Der Begriff des Ideals:* ABRAHAM SCHLESINGER. Ariens-Kappers, *Einführung in die Lehre vom Bau und den Verrichtungen des Nervensystems.* L. Edinger, *The Principles of the Minute Structure of the Nervous System as Revealed by Recent Investigations:* GUSTAV RETZIUS. Koffka, *The Psychophysics of Climate:* E. B. TITCHENER. Köllner, *On the After Images of Subliminally Colored Stimuli:* TITCHENER and PYLE. Kieson, *Über die Wirkung des Stovains auf die Organe des Geschmacks, der Hautempfindungen, des Geruchs und des Gehörs nebst einigen weiterin Beobachtungen über die Wirung des Kokains, des Alipins, und der Karbolsäure ein Gebiete der Empfindungen:* M. PONZO. Müller-Freienfels, *The Psychology of Advertising:* W. D. SCOTT. Lange, *Un cas d'Associa-*

tion latente: E. GOBLOT. Baade, *The Time of Perception as a Measure of Differences in Sensations:* TAIZO NAKASHIMA. Spielmeyer, *Zur Theorie der Halluzinationens;* Kurt Goldstein, *Bemerkungen über das Realitätsurteil von den Halluzinationen:* A. PICK. M. Meyer, *The Perimetry of Sound:* D. STARCH. Lipmann, *Les Synesthésies:* H. LOWRES. Spielmeyer, *Une theorie nouvelle de l'Aphasie:* L. DUGAS. Lange, *La spatialité des faits psychiques:* L. DUPRAT. S. Meyer, *Psychobiologische Grundbegriffe. III. Gefübl und Empfindung;* O. Kohnstamm, *Modifikation der Gefühle:* EDUARD LUTZ. Müller-Freienfels, *Die gemeinsame Wurzel der Kunst, Moral und Wissenschaft:* HERMANN JÄGER. Lange, *Kant's Analytik des Schönen:* K. F. WIZE. Vorbrodt, *Religionspsychologie, empirische Entwicklung studie religiösen Bewusstseins:* E. D. STARBUCK. Lipmann, *Über Freiheit und Zurechnung:* H. SIEBECK.

ANNALEN DER NATURPHILOSOPHIE. Band VIII., Heft 3. August, 1909. *Zur Lehre von der Kausalität* (pp. 273–294): W. H. FRANKL. – The causal judgment justified as deduced from the primary postulate, that the assumptions which lead to an increase of the sum of human knowledge are to be preferred to the assumptions through which that knowledge is decreased. *Entwurf einer allgemeinen Wertlehre auf biologischer Grundlage* (pp. 295–320): R. M. FREIENFELS. – Worth is defined as anything which conduces to the enhancement and preservation of life, whether of an individual or, in the case of conflicts between values that transcend the individual, of as many individuals as possible. *Das Willkürliche in der Welt* (pp. 321–328): A. POCKELS. – In the hypothetical world-formula of Laplace the constants represent the original fortuitous element. In philosophy, the fortuitous is simply the independent. *Über Beziehungen der Gele in der anorganischen Natur zu den Gelen der lebendige Substanz* (pp. 329–332): F. CORNU. *Das Biologische Gedächtnis in der Energetik* (pp. 333–361): E. RIGNANO. – An argument in favor of the central epigenetic theory in contrast to the pangenetic, leading to an explanation of will in terms of energy. *Die Hauptpunkte der Theorien der aktiven Anpassung Schopenhauers und der Lamarckianer und Neuvitalisten* (pp. 362–370): O. PROCHNOW. – Reinke's and Pauly's theories of the influence of dominants are objective restatements of Schopenhauer's theory of active adaptation. *Die Prinzipien der Energetischen Psychologie* (pp. 371–385): N. KRAINSKY. – The energy of ideas is that of the sensory impulse, solely; the greater energy of the muscular contraction is due to stored potential energy. *Neue Bücher* (pp. 386–398): W. O. Heuer, *Krausalität und Notwendigkeit.* R. Petrucci, *Essai sur une Théorie de la vie.* E. Stettheimer, *The Will to Believe as a Basis of the Defense of Religious Faith.* E. Dennert, *Naturwissenschaftlichen Zeitfragen.* A. Rey, *L'énergetique et le mécanisme.* A. Rey, *Leçons élémentaires de psychologie et de philosophie.*

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NOTES AND NEWS

PROFESSOR GEORGE SANTAYANA, of Harvard University, will give six lectures at Columbia University on "Three Philosophical Poets, Lucretius, Dante, and Goethe." Professor Santayana's program is as follows: Thursday, February 3—"Introduction, and Lucretius begun." Friday, February 4—"Lucretius concluded." Monday, February 7—"The Heritage of Dante, his Life, and Minor Works." Tuesday, February 8—"The Divine Comedy." Thursday, February 10—"Goethe's Faust; its Romantic Elements." Friday, February 11—"Goethe's Faust; the Moral of it. General Review."

PROFESSOR JOHN DEWEY, of Columbia University, will deliver six lectures on "Aspects of the Pragmatic Movement of Modern Philosophy" at John Hopkins University, January 31 to February 5. The topics of the lectures are as follows: "Motives for Philosophic Revision, Negative and Positive," "Pragmatic Tendencies in Modern Philosophy," "Phases of Present Pragmatism," "The Biological Foundations," "Equivalents in Logical Theory," "The Problem of Truth."

THE fourth congress for experimental psychology will be held at Innsbruck April 19–22, 1910. The following contributions have been announced: M. Geiger, "Ueber das Wesen und die Bedeutung der Einfühlung"; A. Kreidl, "Die Funktion des Vestibulappartes"; C. von Monakow, "Aufbau und Lokalisation der Bewegungen beim Menschen"; P. Ranschburg, "Ergebnisse der experimentellen Forschung auf dem Gebiete der Pathologie des Gedächtnisses." Communications should be addressed to Professor Dr. Fr. Hillebrand, Innsbruck.

THE Société Française de Philosophie will undertake the publication of a bibliography of French philosophy under the direction of M. V. Delbos, which will comprise the titles of all works and articles published during the year which deal with the subject matter of the bibliography. It will appear once a year in one of the society's bulletins. The bibliography will be partially included in the general international bibliography undertaken at the last international congress of philosophy at Heidelberg.

THE death is announced of Professor R. Schaarschmidt, of the University of Bonn, author of works on Plato, Descartes, Spinoza and Leibniz; of Professor Arleth, of the University of Innsbruck, who has written on the philosophy of Aristotle; and of Salvatore Fragapone, professor of the philosophy of right at the University of Bologna.

THE *Rivista di psicologia applicata* proposes the formation of an association of Italian psychologists with the object of coordinating psychological study in Italy and of participating more effectively in the work of scientific congresses. The organization of the society is entrusted for the present to the *Rivista di psicologia applicata.*

AT the annual public meeting of the Paris Academy of Sciences, the Binoux prizes were awarded to M. P. Duhem for all his works on the history of science, and to M. J. B. de Toni for his studies of the Italian philosophers of the fifteenth and sixteenth centuries.

PRIVATDOZENT DR. BECKER, of Bonn, has been appointed professor of philosophy at the University of Münster. Professor Marbe, of the Frankfurter Akademie für Sozial und Handelswissenschaften, has been appointed at Wurzburg to succeed Professor Külpe, who goes to Bonn.

AT the meeting of the Académie des Sciences Morales et Politiques on December 21 M. Emile Boutroux became president of the academy. Professor Alois Riehl, of Berlin, was elected corresponding member of the section of philosophy.

PROFESSOR J. W. BAIRD, of the University of Illinois, has been appointed professor of psychology at Clark University.

PROFESSOR E. B. TITCHENER, of Cornell University, has been made Sage professor of psychology in the same university. The position is devoted to research.

PROFESSOR ROLAND B. DIXON, of Harvard University, has been elected vice-president of Section H—anthropology and psychology—of the American Association for the Advancement of Science.